

Imagining the Internet

Elon University/Pew Internet Project

A HISTORY AND FORECAST

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Responses to this 2020 scenario were assembled from Internet stakeholders in the 2008 Pew Internet & American Life/Elon University Predictions Survey. Participants were encouraged to provide a written elaboration to explain their answers; they did not always do so, but those who did provided detailed predictive material. Some respondents chose to identify themselves; many did not. We share some—not all—of the responses here. Workplaces of respondents who shared their identity are attributed only for the purpose of indicating a level of expertise; statements reflect personal views. If you would like to participate in the next survey, mail andersj [at] elon dotedu; include information on your expertise.

The 2008 Survey

Scenario One: The Evolution of Mobile Internet Communications

Prediction: The mobile phone is the primary connection tool for most people in the world. In 2020, while "one laptop per child" and other initiatives to bring networked digital communications to everyone are successful on many levels, the mobile phone—now with significant computing power—is the primary Internet connection and the only one for a majority of the people across the world, providing information in a portable, well-connected form at a relatively low price. Telephony is offered under a set of universal standards and protocols accepted by most operators internationally, making for reasonably effortless movement from one part of the world to another. At this point, the "bottom" three-quarters of the world's population account for at least 50% of all people with Internet access—up from 30% in 2005.

Compiled reactions from the 1,196 respondents:

81% Mostly agreed
19% Mostly disagreed
***% Did not respond**

Expert respondents' reactions (N=578):

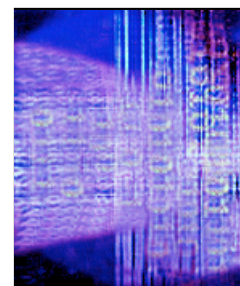
77% Mostly agreed
22% Mostly disagreed
***% Did not respond**

Overview of Respondents' Reactions

A significant majority agreed with the proposed future. The consensus is that mobile devices will continue to grow in impact because people need to be connected, wherever they are; cost-effectiveness and access are motivating factors; the devices of the future will have significant computing power; there is fear that limits set by governments and/or corporations seeking control might impede positive benefits—expected "effortless" connectivity is dependent on their willingness to serve the public good.

Below are select responses from survey participants who agreed to be identified with their statements. This is not the full extent of responses. To see more, read the report PDF, and to read reactions from anonymous participants responding to this question, please click here.

The large-scale models for connectivity, terminal instruments, and use are likely to be set by China. —**Anthony M. Rutkowski**, co-founder of the Internet Society and a founding trustee; longtime leader in International Telecommunication Union; vice president for regulatory affairs, VeriSign



"Telephony" is an odd word, in this context. That would be like calling e-mail "textlephony." The "phone" by 2020 will be as much computer as voice appliance, and the universal standards and protocols will be data-centric rather than voice-centric. **-Clay Shirky**, consultant and professor in the Interactive Telecommunications Program at New York University; an expert on the social and economic effects of Internet technologies

Untethered, 24/7 Internet access will fundamentally redefine how we use information, especially when combined with low-cost heads-up display technologies (eyePods, perhaps?) Augmented reality will automate recognition of real-world objects and 2D/3D overlays and interactions should be well within the processing power of an inexpensive handheld device by 2020. **-Jason Stoddard**, managing partner/strategy at Centric/Agency of Change, an interactive strategies company; he is also a popular speaker on social media and virtual worlds

Three strong drivers: First: Moore's law still drives the diffusion of powerful information and communication technologies to wider and wider markets at lower and lower prices. Cheap chips, cheap phones—manufacturers will continue to deliver less expensive, more powerful mobile devices as they seek to expand into new markets and the price of processors drops. Second: the possibility of openness. Although operators remain significant bottlenecks, fighting to prevent the flowering of innovation-from-anyone that the Internet's open platform enabled, early indicators like VOIP, the Google open telephone effort, growth of Wi-Fi, experiments by Nokia might signal that operators might not be able to maintain the degree of control they have exerted so far. Openness is not guaranteed in the world of wireless broadband networks—but it looks possible. **-Howard Rheingold**, Internet sociologist and author; one of the first to illuminate virtual communities; author of "Virtual Reality," "Smart Mobs," and "Virtual Community"

Mobile phones, PCs, TVs, and other devices will all play important roles. **-David Moschella**, global research director for the Computer Sciences Corporation's Leading Edge Forum; Computerworld columnist

The mobile phone is just beginning to touch our digital lives. As these relatively inexpensive devices continue to improve in performance and connectivity, they will serve more as a "remote control" to many of our electronic touch points, such as: purchasing retail items through scanning, serving as an electronic passport, turning on our cars/GPS systems, translating text to talk, and video conferencing with our friends through our online accounts. As we improve visual projection and "plugging-in" to larger display systems- mobile phones can serve as the old laptop we once new and lugged. **-Drew Diskin**, director of e-strategy, Johns Hopkins Medicine

Basic AI and speech-recognition should improve to the point that many tasks can be done with devices that lack good screens and keyboards, though more-intense tasks will demand those things. **-Brad Templeton**, chairman of the Electronic Frontier Foundation, also of the Foresight Institute, is an Internet pioneer who has been active in the computer-networking community since 1979

Mobile Internet penetration will need a very strong combination of wireless and satellite media in order to achieve ubiquity. **-D.K. Sachdev**, founder and president of SpaceTel Consultancy LLC; early developer of XM Radio

I agree only if the "telephone" has really migrated into a computer/telephone, as seems likely. If phone only, or phone with limited capability of today then it is not robust enough and the \$100 laptop with WI-FI will predominate. **-Ed Lyell**, professor of business and economics, Adams State College, Regis University, San Luis Valley Board of Educational Services; pioneer in issues regarding Internet and education

This is more-or-less a baseline scenario, with the exception of the international interoperability. That seems a bit optimistic. **-Jamais Cascio**, originator of Open the Future, also works with the Institute for the Future, Institute for Ethics and Emerging Technologies, and Worldchanging

However, the Internet access won't be the way we typically think of it—Web surfing, e-mail, social networking. It will be used in very limited fashion—as limited communication mechanisms for simple business transactions and reaching family members. **-Dian Schaffhauser**, writer and editor for CampusTechnology.com, THEJournal.com, Redmond Magazine, Computerworld, and Web Worker Daily; founder of Sourcingmag.com

The mobile phone systems have become the first means of telecommunication. It is only natural that the same system and paradigm is used also for Internet. **-Jonne Soinenen**, manager of Internet affairs for Nokia Siemens Networks, and formerly system engineering manager for Nokia; leader in Internet Society and the Internet Engineering Task Force

Mobile technology will take over in providing access not only to Internet but other multimedia technologies, namely TV. From a business scope, telecom operators and device manufacturers will target to engage more people usage by implementing the "economy of scales" notion.

–Hanane Boujemi, ICT researcher for DiploFoundation, working on educating people about Internet policy and Internet governance, Malta

Cheap, small, easy-to-maintain phones with handheld computer capabilities have become essential for people in unstable climatic and political situations. *–Cliff Figallo, social innovator and original member of the first online community – The WELL, now of AdaptLocal.org; expert in fitting and implementing social Web applications to groups*

The mobile phone is actually a killer app. It might be replaced by a new communication tool in a near future for your social reasons: accessibility, usability are among the threats that will chase the actual phone from the front scene. Users will maintain some interest for the phone but video (now available by phone) demands a screen that mobile will not entirely satisfy for obvious reasons. *–Louis Houle, president of the Internet Society’s Quebec, Canada, chapter*

Assuming the term “mobile phone” means a device capable of multiple access methods (WIMAX, 4G, 5G etc) to deliver TCP/IP based services to the user – i.e. all services on the device are delivered over IP [Internet protocol]. *–Tze-Meng Tan, Multimedia Development Corporation (MDeC), Malaysia, and director at OpenSOS; Internet pioneer as a member of the team that started Malaysia’s largest ISP, TMnet*

Demographic assumptions are okay; affordability and interoperability assumptions are much sketchier. The basket of “typical goods” for those with terrestrial (broadband) access will be so vastly different than the services available over low-cost, handheld wireless that it will no longer be plausible to reckon the two as part of the same “market” (think CB radio vs. telephony). *–Tom Vest, IP network architect and consultant, RIPE NCC Science Group, office of the Chief Scientist; consultant for the Internet Society, and for OECD Economics and Statistics Division*

Internet access will not be carte blanche, but most likely specific data oriented services like fish market data or micro-loan updates. Literacy and the predominance of Mandarin and English on the Internet will be the largest encumbrances followed by cost and regulation (censorship). *–Todd Spraggins, strategic architect, Nortel Carrier Networks; president and chairman of the board of directors of the Communications Platforms Trade Association*

I disagree with that statement because a mobile phone offers limited display and interactivity real estate to the user...I believe all common objects will be connected to the Internet—TV, watch, clothes, car, phone, music player, walls, lamps, tennis racquet ;)—and will all be gateways to the digital world in different fashions. *–Alexandre Winter, co-founder and chief executive officer, LTU Technologies, a global leader in image search and recognition technologies*

Having visited Tanzania in the early 1990s, I was struck by the lack of physical infrastructure for landline phones. It was very clear that they were being leapfrogged by cellular communications. Therefore, it would not be strange at all that similar landline infrastructure for Internet access would be ignored for cellular access. *–Megan Holbrook, partner, Kapow Inc., a site-design and development company; she has produced projects for Microsoft, Warner Bros. and Disney*

Power consumption will be a prime concern and the mobile devices will much of what people need to consume information, create and contribute, and generally communicate. Advances with solar power for small devices greatly lowers the power need for the devices and the transmission towers. *–Thomas Vander Wal, principal and senior consultant, InfoCloud Solutions Inc.; coined the term folksonomy; expert on tagging, the social Web, and social information use and reuse*

Mobile phones also replace our wallets, doubling as identification devices, credit cards, and car keys using RFID tags or a similar technology. *–DJ Strouse, international relations and computer science student, University of Southern California*

Mobile phones are without doubt the most useful technology to connect people around the world and particularly in developing countries. However, the success of the penetration of this technology remains to be seen in the years to come, and will very much depend on the prices offered to users. Developing countries have some of the most expensive prices per minute. A competitive environment should be encouraged through public policies and laws to force mobile phone companies to not only reduce the prices but also to allow compatibility with other technologies such as IP voice in order to increase mobile phone penetration. *–Cristos Velasco, director general of North American Consumer Project on E-Commerce; Mexico-based attorney and active in the Internet Governance Forum and Internet Society*

The mobile device (not phone only) will be the preferred ICT tool of choice for most people. Speech-recognition technology will have changed a lot of how we communicate. *–Robin Gunston, consulting futurist for Mariri Consulting, a strategic and business planning company*

While I agree that cell phones will be the primary connection tool, that will be because of its relatively lower cost and broad abundance throughout the world. I believe people will still

prefer to connect via computer rather than hand-held device simply because of the more robust computing capabilities available, larger screen, and other convenience features they offer. **–Janie Graziani**, *manager of new media and technology for the American Automobile Association*

I think this is true, however, I also think that a big breakthrough will have to do with expanding the phone interface, so that it can ergonomically match the keyboard and computer. One of the easiest/cheapest methods would be the development of cheap "terminals" with keyboard and screens, which you connect to your phone that does the computing. Of course, the crucial thing for success will be the "universal standards" part and the degree to which these standards will result from governmental/world organizations, or whether it will result from a monopolistic company that corners most of the market, so, thus becomes the default standard. The latter scenario could be a disaster. **–Richard Hall**, *professor of information science and technology and co-director of the Laboratory for Information Technology Evaluation, Missouri University of Science and Technology*

People are mobile; they want their Internet access to be mobile also. The key barrier to realizing this ideal world is the price of mobile data access. But it won't happen unless governments break up telecommunications monopolies and require compliance with universal protocols. These steps will ensure the real competition needed to drive down prices and increase access. **–Lea Shaver**, *A2K (Access to Knowledge) Program Coordinator, The Information Society Project at Yale Law School; research includes developing a cross-national access-to-knowledge index*

While I think that OLPC is a great program, I don't see it succeeding to this extent. Given the different stages of cell infrastructure around the world, I don't see them converging on a single standard by 2020. **–Ben Spigel**, *master's student in the department of geography, Ohio State University; researches microgeographies of academic knowledge exchange*

It rather depends on what you mean by a mobile phone of course. But if you consider the type of devices we have these days then screens and functionality are very limited. Functionality issues may be solved by voice-based interfaces but screen size will surely remain a problem, especially as the Web becomes more capable of delivering screen based entertainment. So, no I don't see people turning to mobiles to enjoy the Internet—although they will "snack" online via mobiles. **–Jeremy Swinfen Green**, *Telecom Express, an interactive marketing company*

I am a bit skeptical about the optimum economic output from many other diversified uses. **–Hakikur Rahman**, *chairman, SchoolNet Foundation; coordinator of Sustainable Development Networking Programme in Bangladesh; active in Internet Society Board, South Asia Foundation*

The primacy of the mobile device ("phone") seems assured in the much shorter term. By 2020, we'll have global interoperability either from the top down (ITU-esque alignment of the systems) or from the bottom (phones capable of working on all major networks). **–Alexander Halavaits**, *professor and social informatics researcher, Quinnipiac University; explores the ways in which social computing influences society*

I'm skeptical about the widespread adoption of technical standards, particularly wrt telephony. Also—the term *mobile phone* will probably be quite redundant imho, probably identifying you as an anachronism of the fixed, voice-only era. In 2020, my son (now 6 months old) will turn 13. He'll think "phone" and "mobile" are endearing terms (like we think of "the wireless," or "the terminal"...) wrt mobility, I'm pretty sure that fixed displays (capable of greater size etc.) will play a large part in communications too, but, as with the increased complexity of a/v communication, these fixed elements will be more integrated into a complex ecosystem of devices and protocols. **–Jeremy Yuille**, *digital media coordinator at RMIT Communication Design and program manager at ACID in Melbourne, Australia; previously director at IXDA, the Interaction Design Association*

Mostly agree but I don't think this in any way erodes the good work of the one laptop per child project. Mobile phone space and Internet space are still have very different qualities. **–Christine Satchell**, *Ph.D., senior researcher, Institute for Creative Industries and Innovation, Queensland University of Technology*

This is likely to be the dominant means of Internet penetration in developing countries but Internet access for most in the developed world will also have migrated to cell phones or cell phone-like devices. Laptop- and desktop-tethered Internet access will be mainly for offices and those who use it professionally. **–Jade Miller**, *Ph.D. student Annenberg School for Communication at the University of Southern California, with a research focus on global flows of information and culture*

This follows Nokia's ideal of the "mini computer" or "computer in my pocket" notion that as handsets like the n series including the n95 were designed in the early 2000s to be a mini computer that could be carried about on the person. Research that was carried out in 2005 in Japan by Ito et al (2005) has shown how important the portability of this kind of technology;

that relies on being portable and personable. Other research that has taken place in India by Chip Chase has shown how limited infrastructure in terms of broadband and wireless can encourage a 'leapfrogging' of technology, where the PC and laptop were not the primary method for Internet connection as the mobile phone was a technology that was more easily available, affordable and reliable in this area. **-Maz Hardey**, social analyst, blogger, "defender of new media" completing a doctorate funded by the Economic Social Research Council in the UK, based at the University of York

While I'd agree that the "majority" of people who have (personal/family etc) Internet access will have mobile access, I'm not sure it will be the majority of the world; simply the majority of the connected world. For educational purposes it's more likely to be computer-(including laptops, etc.)-based. Probably business will be mobile oriented (if people only have one way of accessing net). **-Emma Duke-Williams**, lecturer in the School of Computing and researcher, University of Portsmouth, United Kingdom; education blogger

The statistics on the penetration of mobile handsets show that phones are a significant platform. If you include voice calls and SMS as a baseline data entry point, perfectly reasonable in answer to the stated query "primary connection tool" that doesn't explicitly focus on "data connection," then this statement is already true, in that most people can receive very useful up-to-date information via SMS or voice enabled services in most countries in the world. These services may well be hosted on platforms that provide Web, SMS and voice access to the same back end data. The same cannot be said of any form of computer (PDA, laptop, ...). The trend is clearly for more computing complexity in the phones, and richer interfaces at least in some segments of mobile handset (business smartphones, and consumer mediaphones in particular). If and when voice telephony is affordable and of good quality over the data networks on these devices then the voice will have become just another service on these personal communications devices; this has not quite happened yet. It will require the development of open SIP stacks for handsets that utilise the full power of the inbuilt codecs. If all these phones were also IPv6 enabled, as was originally envisaged in the IMS strategy of the 3GPP and others, there is a huge potential for new innovative peer-to-peer services allowing these handsets to exchange information with each other. **-Micheál Ó Foghlú**, Research Director, Telecommunications Software & Systems Group, Waterford Institute of Technology, Ireland advisory committee; member of W3C; blogger

Although it is highly likely that a large proportion of people in the "bottom" three-quarters of the world's population would have access to a mobile phone, it is highly unlikely in my opinion that they would be accessing the Internet. There are two primary reasons for this: (1) The capacity of the cheap mobile phones being planned is not that which is required for Internet access. See for example the Rs. 1000 phone to be launch by BSNL in India—these are pretty basic phones to be deployed over the next five years; (2) Even if the equipment were available, it is questionable whether the level of awareness and education required to use the Internet on a mobile phone would be able to be provided. In the first instance, people would have to consider using the Internet, and thus learning about it a NECESSITY. Will it be necessity, compared to food and basic literacy? The Internet is far more complex than transacting a conversation which is a small extension of current cultural and individual practices. **-Amit Kelkar**, consultant and sociology researcher, Postmodern

I only mostly agree if there are some breakthroughs in UI so that the limitations of screen size and entry are addressed. I do believe this is possible. We have to assume that the cost of the devices will approach zero as well. **-Robert J. Berger**, CTO for Cinch; expert on backbone networks, access networks, wireless networks, and innovative Web applications, a frequent speaker on Next-Generation Networks

Of course this is not the mobile phone as we know it today, which has ergonomic problems for continued use of small keyboard and screen. **-Giulio Prisco**, chief executive officer of Metafuturing Second Life; formerly department head at the European Satellite Centre, analyst at European Space Agency, and an IT specialist for CERN

In many poor, remote areas where individuals can't own phones, they still have access because of phone-sharing schemes. This nixes casual use, but still brings vast connectivity to services they find essential. **-Jerry Michalski**, founder and president, Sociate, a technology consulting firm; formerly managing editor of Release 1.0, Esther Dyson's newsletter and co-host of the annual PC Forum

Networked digital communications are extremely useful and are developing indigenously. People love their mobile phones, but the screens and keyboards are too small to be THE ONLY CONNECTION. Shared machines are really quite workable, even if not the preferred format of rich Westerners. As to WORLDWIDE "universal standards and protocols," that hasn't been true of mobile phones, TV, electrical standards, and by the way, when will the US adopt the metric system? (although conversion is always possible). **-Seth Finkelstein**, anti-censorship activist and programmer, author of the Infothought blog and an EFF Pioneer Award winner

Actually I am intrigued by the possibility of what Mark R. Anderson has called the "Carry-Along-PC" combined with the various efforts to get cheap laptops to the world. I suspect the

result will be a device that is a cross between today's cell phone and today's laptop. **-Rollie Cole**, director of technology policy, Sagamore Institute for Policy Research, a nonprofit, nonpartisan think tank headquartered in Indianapolis, IN

For most of the world, I assume this will be true, due to current market penetration; however, I do exclude the US from this prediction. While mobile technology has penetrated throughout the nation, I don't believe the US will see anything like universal standards by 2020 because of the corporate monopolies with great power, who are using that power to make certain it doesn't happen. In the rest of the world, that power does not hold such absolute sway. But at the same time as the wonderful XO machine appears, India also is facing declining literacy rates, problems that, around the world due to the increase in poverty and slavery in the developing world, makes it harder for populist computing to take hold. If your entire 18-hour day is spent in a sweatshop, and you are locked in a "dormitory" at night, when are you going to interact and build on a culture that might USE the XO and the machines that come after it? **-Christine Boese**, Ph.D., researcher and analyst for Avenue A-Razorfish and Microsoft

Mobile telephones are likely to be more affordable and accessible than laptops or PCs, so it's feasible that more people will use this technology as a connection medium. **-Sam Ozay**, e-learning and e-communication specialist and solutions architect at Postmodern (Asia/Pacific); formerly general manager at European Language Centre

I think the google phone certainly has the potential to enter the expanding market of browserability of cell phones and interoperability with other platforms. Per-minute charge to browse has to be drastically reduced for most remote access phones to be online and that is dependent on critical mass use, which is connected with the need for using the Internet, something the cell phones itself won't be able to bring down. **-Shakib Ahsan**, MBA and MA in educational technology, now at Concordia University, Canada

This will be true, in as much as the device will deal with phone calls. I doubt whether it is anything close to the traditional mobile phone we know today. **-Sam Smith**, Web interface developer, University of Manchester, UK

Mostly agree, however, I expect even poor people to relish ownership of multiple devices, not just a phone. **-Brough Turner**, chief technology officer and co-founder of NMS Communications; oversees evolution of technology and product architectures

The mobile will be the universal device and mobile infrastructure is the only one deployed in all parts of the world. The multi-purposes facet and the easy of use of mobile is making it the appreciated way to be connected. But the connections fees and the mobile's cost must decrease. **-Rafik Dammak**, software engineer, STMicroelectronics, Tunisia; DiploFoundation participant in the study of Internet

Because the scenario is worded, "for most people" I would agree that the mobile phone is the primary connection. But, practically, that is true only because it will be the only connection for too many. The primary connection will be some device that provides a greater range of visual capability and be less portable. Further, the "mobile phone" intended in the scenario, will be replaced by something else that will have telephone capability as an adjunct. **-Don Heath**, Internet pioneer; former president and CEO of the Internet Society; member of U.S. State Department Advisory Committee on International Communication and Information Policy

While this appears reasonable, I also note predictions that the bulk of Internet traffic will be between processes or devices (or user agents) rather than between people themselves. Therefore, it is ALSO quite likely that the class "people as users" will become an increasingly smaller fraction of Internet accessors. This does not contradict your prediction; it just qualifies it further. **-Steve Goldstein**, ICANN Board member, retired from National Science Foundation, where his job in the 1990s was to help diffuse the Internet globally

I don't think that mobile phones will be the primary connection tool. It may be right that mobile networks will provide a substantial part of Internet connectivity, but I think the hardware industry will come up with some new appliances to compete with mobile phones. Treos and BlackBerries will still be focused on upper scale segments, and some new accessible thin-client appliance will appear in the near future. **-Sebastian Ricciardi**, associate with Jauregui & Associates, a law firm in Buenos Aires; leader in the Argentina chapter of the Internet Society, formerly of ICANN's At-Large Advisory Committee

Well, sure, wireless services will always be available in more places than wired, because the build-out is so much cheaper. **-John Levine**, founder of Taughannock Networks; a leader of the Internet Research Task Force's Anti-Spam Research Group and the Coalition Against Unsolicited Commercial E-mail

Mobile phones are affordable, portable, and a virtual appendage for several generations. It is only logical that it will become the primary Internet connection. **-Hinda Feige Greenberg**, Ph.D., director of the information center for the Robert Wood Johnson Foundation, dedicated to improving healthcare for Americans

The cell phone has become a primary tool for converging information technologies that is widely accessible and relatively easy to use. As the continuing rapid diffusion of cell phone technologies increase within modern society and the convergent depth of cell phone information services broadens, we will see the cell phone used as a primary access point for information services that are now accessed via the computer. **–Gary Kreps**, *chair of the department of communication, George Mason University; formerly founding chief of the health communication and informatics branch of the National Cancer Institute*

By 2020 the phone will be melting away into the environment, its functions provided by distributed, intelligent components. People will talk to—and through—their cars, desks, etc. **–Greg Laudeman**, *utilization catalyst and facilitator, community technology specialist, Georgia Tech Enterprise Innovation Institute*

As screens get bigger everyone will use a mobile device to access the Internet. Everyone! **–Dan Lynch**, *founder of CyberCash Inc. and Interop Company and an Internet pioneer; board member of Santa Fe Institute; director of computing for SRI International in the late 1970s*

Mobile devices have the potential to bring the power of the Internet off the desktop and out into the world. Will lead to further blurring of the digital and the analog realms. Phones are likely to become our way to access a variety of public and semi-public I/O [input-output] devices as well as a readily available personal portal to online data and applications. **–Jim Witte**, *professor of sociology, Clemson University; research is focused on differences between online and offline society, including a special interest in activity in Second Life*

I agree that the mobile phone will be the connection tool of choice for most by that time, but if the providers of those phones wish to achieve that lofty position, they will need to work together to create an open architecture that allows the phone to access different platforms on a per-use basis rather than a subscription. This "ala carte" methodology will enhance the experience for users and encourage users to try new platforms. **–Hal Widsten**, *general manager, KWED/Seguin Daily news, Guadalupe Media Ltd.*

By 2020, I believe the "bottom" three-quarters of the world's population will account for at least 60% of all people with Internet access. The convergence of traditional desktop or laptop computing will have transitioned to the next level: Mobile Computing in the form of, for want of better term, mobile phone platform. Add-ons and accessories such as VR goggles integrated with the mobile phone will allow worldwide mobile computing to completely replacing the desktop/laptop platform in many cases. **–Thomas Quilty**, *president, BD Consulting and Investigations Inc., a firm that investigates and provides services tied to software piracy, trade-secret theft, and other high-tech concerns*

A hybrid computer and phone combination more akin to the ASUS eee (which has phone capability) will come into use. They will have more ways to input data but will include a full keyboard of some time and be capable of all laptop as well as phone functions. **–Bruce Turner**, *director of planning services for a U.S. regional transportation commission; retired from U.S. military*

I agree that there will be a convergent computing/telephony device, but I'm not so sure they'll be called—or perhaps even recognized—as mobile phones. **–Aaron Schmidt**, *Walking Paper Consulting, a blogger who writes about libraries, technology, and usability*

The "mobile phone" people will be using as the primary access point in 2020 will be a completely different animal than today's mobile phone, or today's PC for that matter. It will be a very personalized device for entertainment, communications, productivity, location awareness, and financial transactions. **–Mark Youman**, *principal, ICF International, a Washington, DC, consulting-services company that works with government and commercial clients*

I agree but the phones will be regulated by the governments on many of the developing countries with chips that will control content and spy on the user as a way of keeping control...there will be a worldwide black market for "stripped" phones, since the government will know if you try to tamper with one of the official phones. **–Garland T. McCoy**, *founder, Technology Policy Institute, a think tank focused on the economics of innovation; formerly senior vice president at the Progress and Freedom Foundation*

Originally mobile phones were much like text browsing in the early days of the Internet. Broadband has come a long way since then and laptops are become smaller and more technology has converged with each other's platforms in mind. Don't be surprised if the communication devices as we know them today will be as simple as a watch with a hologram feature for viewing frames. **–Mark Terranova**, *senior account manager, I Group Electronics, an electronic component distributor*

I think use of the Internet will be qualitatively different for people who access by phone or computer. Phone access will be used for quick transactions. The Internet has great information but phones will never be able to display this information as well as computers from a human-

factors viewpoint. **–Todd Wagner**, health economist, Health Economics Resource Center, Palo Alto, part of the US Veterans Administration; also involved with the Center for Healthcare Evaluation

Believe mobile "devices" is a better term, since the evolution of devices is rapid. It may not be called a mobile phone, but it will be mobile, have multiple application capability and work anywhere. **–John Murphy**, director USA.gov technologies, General Services Administration of the U.S. government

The ongoing hindrance with mobile phones is the size of the screen. That being the case, I can't accept the basic premise of your scenario, that a phone would be the primary Internet connection. **–Jill O'Neill**, director of planning and communication, National Federation of Abstracting and Information Services; author of the Infoday blog; based in the Philadelphia area

The cell phone is smaller and (usually) cheaper than a laptop. If indeed there are universal standards and interchangeability, it could be this powerful. **–Judith Siess**, president of Information Bridges International Inc. and publisher and editor of the One-Person Library newsletter, author and blogger

The keyboard is too small to type on comfortably on a mobile phone and most people will continue to spend hours at work and home seated at their computers. You fail to mention whether the mobile phone will come down in cost, currently at \$400 for a Nokia and more for other lines, only the wealthy can afford the phones—you don't explain how this cost gets lower in the future persuasively. **–Catherine A. Fitzpatrick**, Open Society Institute, Physicians for Human Rights; lecturer on humanitarian issues; formerly UN representative for International League of Human Rights

Most of the US and will be wireless, if by mobile phone or other means. If you look at the numbers, the mobile phone is a technology that has quickly infiltrated every single aspect of society, whereas iPods, laptops and other items seem to still stink of digital divide. While the US has not advanced as quickly using mobile phones for SMS and Web surfing, I'm sure we will be there soon. **–Tiffany Shackelford**, consultant who works with clients such as Phase 2 Technology, Stateline.org, Foneshow, WebbMedia, and Daily Me

Short of some black swan (and who would rule that out!), anyone traveling overseas can observe that the cell phone is central to people's lives at the moment. For many people, cellular technology does an end run around other connectivity issues—building wired or WiFi networks, the duke-it-outs between would-be providers—creating a de facto network of its own. It may not be a "phone" by then, but yes, the computer will travel with us and probably replace the wallet and keys we now grab as we head out the door. **–Karen G. Schneider**, research and development College Center for Library Automation, Tallahassee, Florida; expert and thought-leader in the library and technology community

The physical interface is too small for this to be the primary connection tool, unless there is a way to "unfold" the screen and make it larger and closer to the size of today's notebooks. **–Tim Terpstra**, co-founder of Teletekst Is Dood and cultural (media) entrepreneur, editor, researcher, developer for The Generator/TodaysArt Festival, the Hague, Netherlands

I think we will be more likely device independent, with the gizmo we use to access the net being less personalized and less of a "thing." Maybe a small earring, or tattoo with which one interfaces via galvanic skin responses or via eye movements...but interfacing with something connected as part of a larger central system. Would allow governmental control. Yes, standards and protocols should align worldwide. **–Kathryn Greenhill**, emerging technologies specialist, Murdoch University

I am not sure that we can say they are just two tools to access Internet. In fact we will have a lot of different tools to do that. Television, your car, laptop, mobile phone (more or less intelligent)... **–Sebastien Bachollet**, president of the Internet Society of France, operates the European Global Event on domain Names and Address systems, known as EGENI, active participant in ICANN

For many, information and entertainment channels will flow freely into powerful handheld devices. Users will create their own customized, ultra-personal news feeds, music channels and video portals via phone interfaces. The iPhone hints at this now. **–Michael Stephens**, assistant professor, graduate school of library and information science, Dominican University, River Forest, Illinois; an expert on "Library 2.0"

It's more likely that cheap, simple telephony will come to inexpensive mobile Internet devices than that more people will use dedicated mobile phones as we know them today for their main Internet usage. In addition, I believe device form factors will continue to evolve so that by 2020, the term "mobile phone" may no longer be meaningful in the way it is today. **–Dave Coustan**, author of the Extraface blog and an independent consultant who formerly wrote EarthLink's official blog, Earthling, and Stuffo, a sub-brand of HowStuffWorks.com

In the medical/scientific field 90% of the technology we'll be using in 15-20 years hasn't even been thought of yet. Therefore, while it may be the mobile phone that connects so many to the Internet in 2020...it may well be something much more technologically advanced, smaller, more powerful and so user friendly—that uneducated people in undeveloped and underdeveloped countries will have access to it and be able to use it, easily. —**Dan Larson**, president and CEO of PKD Foundation, a non-profit organization working for patient advocacy and education

While I agree mobile phones will dominate Internet connections in the future, I believe there will be a significant space reserved for highly portable laptop or tablet devices that enable larger views of the incredible graphic presentations now found throughout the Web world. —**Bill Warren**, vice president of government relations, Walt Disney World; founding editor of the Orlando Business Journal

While the idea of one laptop per child is a great ideal, the use of phones will prove to be much more possible. —**Ken Mitnick**, Down to Earth Software USA Inc., providing software for Real Estate professionals

Worldwide access among all incomes will not happen until there is a free channel for connection. The current connection model that revolves around telephone/mobile providers cannot work for people with no money. The network suggested by Negroponte will connect people with no electricity. —**Buddy Scalera**, vice president for interactive content and market research for CommonHealth Qi, in charge of interactive online strategies, including social and viral marketing

Communications will be the currency of the next decade, with telephony the gold. —**Stan Felder**, president and chief executive officer, Felder Communications, a marketing and advertising firm in Grand Rapids, MI

I disagree with the last statement. I believe the technology disparities will grow wider. Access to knowledge is a greater barrier than access to other resources, except nutrition. As technology becomes more advanced the digital divide will become greater. —**Debbie Murray**, associate director, health education through extension, University of Kentucky

I think this is mostly accurate however, I still believe that laptops will still have a very large role to play in 2020 especially for the 3rd world countries. In America, England, and Japan and the likes there will be a heavy shift to mobile technologies, with the advent of technologies like the iPhone playing a bigger role. The move to open standards will have finally taken hold back in 2015 and people will embrace the open standards by 2020 with little thought about it. —**David Newberger**, founder of Blackdot Ventures and systems administrator for Minneapolis Convention and Visitors Bureau, Minnesota

Look in today's public libraries for a clue as to the need for widespread public access to the Web. Many relatively low paying jobs require an online application. Even the simplest tax situations are more easily addressed with the aid of online tax preparation software free on the net to lower income people. Public librarians are becoming informal experts on how to access these services for their lower income customers. It's hard to believe that these functions could someday be done from a mobile phone but I'll allow that it may happen. —**Jerry McCann**, vice president and director of the social marketing group at Carton Donofrio Partners Inc., marketing and advertising firm in the Washington, D.C., area

While it will take a while for mobile phones with significant computing power to become cheap enough for widespread distribution in developing countries, mobile phone will indeed be the primary means of communication, both via voice and via Web. This development is going to support—and be supported—by both the opportunity to be always conducting transactions online and by the opportunities inherent in localized services through the mobile Web. It should be interesting to see which role product piracy and the open source movement will play in this development. —**Peter Bihr**, freelance consultant on Web strategies, communities, blogging and social media based in Berlin, Germany

Mobile phone seems to be materializing convergence better than any other gadgets. Laptops are a good rival but mobile beats them in being cheaper and more practical by size and in terms of carryability. —**Erkan Saka**, lecturer in media and communications systems at Istanbul Bilgi University

Bricks and wires will be somewhat outmoded and clicks and spires will take their place for much of the world. If telephony administrators can agree on standards and protocols, phones will increase in options and decrease in price as computers have, allowing more people across SES and national boundaries. —**Dorothy E. Finnegan**, associate professor of education, the College of William and Mary

You are correct as to the impact of mobile technology, however the penetration of low-cost PCs and notebooks will be more difficult due to lack of many other priority resources in the poorer countries, like housing, sanitation, etc. Also the cooperation among telecom and Internet

service providers will be the same as it is today: this means strong competition and only basic common protocols. **–João Miguel Rocha Filho**, director, DataOne, a provider of software for connecting to Linux; based in Brazil

The mobile is profoundly liberating and equalizing for the individual, providing access to what is known by humankind. We can only begin to understand how this will transform human experience, but I think all the news is good. **–Judy Breck**, blogger at GoldenSwamp.com – aimed at "watching the global golden age of learning emerge from the open Internet"

Open Source will provide a popular mobile OS that consumers can choose to install over corporate devices sold online or at retail locations. **–Don Kasprzak**, chief executive officer of Panaround.com, a Web-solutions design company; former system engineer at Apple Computer

Consider the vast changes in mobile phone technology that have occurred in the past 15 years and the increased use of mobile phones across all age groups in developed countries. Expanded networks, connectivity, and affordability have also provided sweeping transformation in developing nations. These factors coupled with the pervasive cross-generational desire—in developed nations—to be connected and accessible any time/any place makes this scenario seem inevitable. **–Carol Schwartz**, distance learning coordinator, Northwest State Community College, Toledo, Ohio

Although I strongly agree that the mobile phone could be the primary connection tool by 2020, who can predict the future? It is way too dynamic. However, looking at things like the Nokia N95 or the iPhone, you can see the power of a hand-held to do just about everything, including being a computer, phone, camera, radio, video projector, GPS. Really take all your gear now and wrap it into one device that you can stick in your pocket and that will be the future. We will look back at 2008 and say, "Can you imagine, we needed a backpack to carry everything you have in the palm of your hand now." **–Leonard Witt**, associate professor in communication, Kennesaw State University, Georgia; research interest is citizen journalism and user-generated content; author of Weblog PJNet.org

The low-cost, high-tech mobile phone is more accessible and more practical than a computer and will prove to be an even more powerful force in future. **–Joan Connell**, online editor, The Nation magazine, formerly an executive producer for MSNBC.com, senior editor for MSN and a Pulitzer finalist for her reporting

I think "phone" is a bit of a misnomer here. If one envisions something akin to the current Blackberry, with a reasonable sized screen and keyboard/data entry functions that resemble a laptop then yes, I think phones will be the primary means of communications. Already, we are seeing people use tools like PDA-Smartphones in ways that resemble laptop computers, phones like PDAs and laptops like phones. Portability and consolidation towards a single tool is happening now and will continue. **–Cameron Norman**, assistant professor in the department of public health sciences, the University of Toronto; actively engaged in use of the Internet to help tackle tough health issues, including work with the Centre for Global eHealth evaluation

The direction is toward small, cheap, and mobile in technology. I don't see that changing. **–Alexis Chontos**, Webmaster, the Art Institute of Pittsburgh

Cell phones are currently in the majority of the students' hands that I work with at this medical center, and I see that increasing as the years go by, making the mobile phones sources for communication and information. While the younger eyes may be able to use the Internet on their mobile phones, the mobile industry will need to adapt to the millions of aging eyes—it is hard to use the current screens with bifocals, making accessing Internet content more difficult than using a desktop screen. **–Teresa Hartman**, associate professor and head of education, University of Nebraska Medical Center

The mobile phone is too cumbersome—mostly because of its size—to do much of the professional work now done on the Internet. My hope is that by making wireless technology available to a larger part of the world, we can eliminate some of the communication barriers that are responsible much of the misery and destruction in the world. **–Mike Samson**, interactive media writer and producer

I mostly agree with certain reservations. I agree based on the fact that the whole world i.e. second- and third-world countries are included. However using present technology, which will by then have could have changed significantly, we will still be restricted in ease of use and using the Web as an extension of one's work life. Instead, whilst the mobile element will be significant, I believe that the home network, especially in conjunction with in house entertainment/workstation, as is already visible, will be the main stronghold of Internet usage. The mobile will act as the on the go, quick check/mail/travel-entertainment module, updating seamlessly with the home net. **–Robert Eller**, Concept Omega, a media marketing and communication company

By 2020, mobile phone companies will have had to adjust to meet consumer demands for increased mobility, interoperability with competing networks, increased bandwidth, and lower

prices. Advances in technology will lower the price for smartphones while increasing what they can do. This will result in most of the Internet being available on mobile phones as well as a much richer multimedia experience. Because the essential Internet tools will be available via mobile phones, many people will have no need for home Internet connections. **–Jamie Richard Wilson**, *journalist and freelance Web developer*

Our thinking about the Internet has always been based on a desktop concept. The recent spike in notebook sales and the expansion of Web enabled mobile phones is just the beginning of our shift from home-based digi-world connectivity to a truly mobile universe. **–Stephen Schur**, *director of online communications, Ramapo College of New Jersey, U.S.*

Additionally, I think it's likely that many of the functions of "the Internet" will fade into the background; e.g., banking and credit card payment will no longer be accessed via Websites but will be an integrated feature of mobile devices (as they increasingly are already in many LDCs). **–Jacob Kramer-Duffield**, *blogger and student, UNC School of Information and Library Science*

Relevant caveat: The road towards "a relatively low price" is a bumpy one. European operators for instance had to be forced by the EU to significantly lower their roaming tariffs and this shows us that the industry always opts for "concerted action" if given the opportunity. I believe that corporate attitude will not change in the next decade or so; something else has to, in order to achieve such a scenario (perhaps by means of tough and "citizenship-oriented" regulation...). **–Luis Santos**, *Universidade do Minho—Braga, Portugal*

I believe that as early as 2010, the majority of global Internet access will be via a mobile device. This trend will be accelerated by things like the ubiquity of wireless broadband in markets like the US after February, 2009. **–Chris Marriott**, *vice president and general manager for Acxiom Digital, a marketing company*

With added connectivity through a range of computers (those infused into everyday things, those carried by choice, those accessed from stationary workstations, and so on), it is possible that the mobile phone will become the "babble fish" of the 21st century—the tool that instantly translates any language (human, machine, or otherwise) to any other language. **–Ed Dieterle**, *Harvard Graduate School of Education; research tied to handheld devices for ubiquitous learning*

Most people want a smartphone to access their own stored data (phone numbers and addresses), as well as to get point information from others (directions, text messages, Wikipedia). This means that these phones will grow in popularity and use because they are made for people to use connectivity in a simple, direct form. Laptops allow for more complex connectivity, but this will become increasingly marginalized. **–John Jordan**, *associate professor of communications, University of Wisconsin-Milwaukee*

1 laptop per child will fail, and most people in the world will still not have a reliable electricity source to power a phone, computer, or even a light bulb. While telephones will certainly become more like computers (e.g., the iPhone), they will not be able to compete with more traditional computer configurations in terms of content creation. And it is in the area of content creation that the computer has had its greatest impact: readers more and more are becoming writers—not content copiers, which is the traditional role for most writers, but originators and publishers of content. **–Dennis Baron**, *professor of English and linguistics, University of Illinois, runs the Web of Language site and researches the technologies of communication*

While it's true that cell phones are gaining significant computing power, the more important issue is user interaction. Many online services could offer a great deal of functionality through a voice or cell phone touchpad interface; but the majority of online services are best interacted with via a mouse and full sized keyboard. In terms of worldwide access, it's more likely that the digital divide will first be bridged by shared devices and connections, like Internet cafes, than it will by each individual owning a device, whether laptop or phone. **–Jay Neely**, *social strategist in the process of founding News Armada, a Boston-based company working to advance Internet-based news and commentary and community online*

The mobile phone will be used daily/hourly/minutes as a Web client by most of the online population. But the idea of a "primary Internet connection" will be increasingly obsolete. Many devices will connect to the Internet, for various reasons, and the very idea of consciously "connecting to the Internet" will seem quaint in many parts of the world. **–Walt Dickie**, *executive vice president and chief technology officer, C&R Research, one of the principal developers of CheckMetrix in the early '90s.*

The mobile telephone will likely be a significant vehicle for the majority of the population to engage in personal information access and sharing. This will likely occur via text, orally, and one-to-one video. I am reluctant to accept that the small screen of a mobile phone or similar personal mobile access device will have the capabilities for multi-person interaction and collaboration as is now occurring with personal computers (Web based conferencing, etc). This

maintains a distinction between personal interaction and professional use. **–Julie Anne Lytle**, Ph.D., educator and online learning coordinator, Episcopal Divinity School

While it is probably true that these small, relatively cheap devices will find their way throughout the low-income areas of the world, they will probably not be much like phones as we know them. They will be capable of making calls, but will be much more integrated data-carrying devices. As such, in many cases, large notebook computers may become less necessary anyway. **–Sam McAfee**, chief technology officer and owner, RadicalFusion, a company that offers consulting on Web design and development, server-side programming and database development

I do not believe this transformation would be possible in only 12 years...too expensive and too much infrastructure would have to be completed...even in highly technical California there has been delay in establishing free and inclusive WiFi. **–Patti Harrington**, development associate, diocese of San Jose

New access to the Internet by large segments of societies without any previous experience or conceptions of what the Internet "should" do will open up a whole new range of applications and services we can't even imagine today. **–Joe McCarthy**, principal instigator, MyStrands; formerly principal scientist at Nokia Research Center Palo Alto; he also has worked at Intel Research, Accenture Technology Labs, and Nokia

I think we will see a substantial change in what constitutes a mobile telephone. New generation phones will be both portable computer and phone (more like the PDA phones). They will be connected to the Internet but will only constitute the major form of access as they develop "screens" that are easier to read. **–Naomi L. Lacy**, assistant professor, research division, University of Nebraska Medical Center

Mobile phones are seeing an increasing trend towards innovative applications. The mobile has become a tool of convenience and empowerment. **–Syamant Sandhir**, director, Futurescape Netcom Pvt. Ltd., an experience-design and implementation company

There will be tremendous pressure from the users to globalize communications and almost equal pressure by communication companies to maintain proprietary platforms that prevent the phone from being a global connection tool. I think we will also need to overcome the issue of reading a screen that is no bigger than a note card. **–Mark Fennell**, senior Web engineer, Athens Regional Medical Center, Athens, GA

Log file data today and year after year so far shows that mobile phone Internet access has not taken off in the US, even with the advent of the Blackberry and iPhone. It is highly speculative that it will be the "dominant" technology or that it will be desirable in the future. Costs will need to come down first. Currently, it is \$80/month for iPhone service with decent Internet connectivity. This is in comparison to \$35/month service otherwise. Equally valid arguments could be made that the TV will be the main connection point in 2020. But my gut says that actually it will be the laptop computer with its portability, the size of the keyboard and screen and the preference for e-mail over talk. **–Theresa Maddix**, satisfaction research analyst, ForeSee Results

The desktop computer will be largely gone by 2020, and people will all use some kind of mobile connection device. Whether that is a phone or a mini-laptop will depend on the user and applications they need. **–Lisa Carr**, director of strategy, Targetbase Interactive, healthcare strategist and writer

The mobile phone/device blurs the lines between personal and professional time and users like that. They can use it during "down time" to stay connected or manage their lives and those of their families. I don't see myself willing to give that up and I think technology to support the ongoing adaptation of more Internet resources to mobile devices will be well-received. **–Stephanie Geyer**, associate vice president e-communications and Web strategy, Noel-Levitz, an operating division of Sallie Mae that consults on recruitment and marketing of higher education

I agree with this insofar as I do not believe the personal computer will be the primary method of connection for most people; however, I also suspect that believing our only two options 13 years from now will be "phone" or "computer" is uncreative and fails to anticipate that the real answer will probably be "something else entirely." **–Alexis Turner**, Webmaster, Greenwood Publishing Group, New York

Computers get smaller and fit almost everything you could want into a phone. Yes! This is already happening, but will happen more cheaply and therefore widely. **–Mariana Almeida**, product manager of Web products for healthcare, Kaiser Permanente

Phone network providers cannot possibly make a profit by building out and maintaining the infrastructure required to bring this scenario to fruition. And that infrastructure is subject to vandalism, rendering it useless in situations ranging from political dissidence to terrorism. **–John Jobst**, IT specialist, U.S. Army Corps of Engineers

It's the direction we're heading. We're more than likely to be using computing power outside the desktop in many or most cases. **-David Allen, Ph.D., Temple University**

By 2020, one would hope the equivalent of today's iPhone will be affordable even in low-income economies. **-Brian T. Nakamoto, co-founder of MrJoy Inc. and product-line manager for Everyone.net, (a leading provider of outsourced e-mail solutions for individuals and companies around the world)**

Of course, by 2020 (or even 2010), the term "mobile phone" will be an anachronism, as mobile devices increasingly become all-purpose connection tools, using innovative interface techniques to broaden their uses. **-Ivor Tossell, technology columnist/journalist for the Toronto Globe and Mail, known as "the blogging journalist" and a social observer**

In total I agree to the scenario but I expect it will take more time to become reality, maybe till 2030. **-Jutta Croll, managing director, Stiftung Digitale Chancen - Digital Opportunities Foundation, Berlin, Germany, promoting and supporting access and equal opportunities for all online**

Over the next decade the mobile phone will be transformed by many entirely new applications and the voice interface will be exploited through voice recognition. **-Ed Steinmueller, professor, science and technology policy research, University of Sussex; researches industrial structure of high technology industries, co-evolution of technology**

A further important influence to support this outcome is the increasingly critical need to reduce carbon footprints with mobile communications enabling a reduction in travel. **-Tim Grafton, market research director for UMR Research Ltd., a market research company based in New Zealand**

The mobile phone and wireless technology generally will certainly dominate for the next 5+ years. After that, new offshoots will evolve, almost certainly in ways we cannot imagine. **-Jasmine Sante, Sante Strategies, independent Web strategy consultant in the Washington, D.C., area**

Some intelligent cell phones are able right now to do as much as a computer is doing. I'm thinking about the N95 of Nokia. So it's safe for me to say that in a really near future, the cell phone will be pretty much THE device used to access information in our society, being on the Net or other proprietary networks. **-Bruno Guglielminetti, producer for Radio-Canada, multimedia producer and blogger**

This is very true. The US will remain behind, especially for older generations (40+ years old). Augmented-reality functions will be commonplace, building out a set of mirror worlds. **-Bryan Alexander, director of research National Institute for Technology and Liberal Education, blogger, expert on computer-mediated pedagogy, Ripton, Vermont**

The mobile "phone" will indeed play such a role thanks to a great improvement in the ability to use them. Specific functions for use of the Internet will be shaping that use. For other types of functions, other devices will be used. **-Wim van de Donk, professor of public administration and chairman of the Scientific Council for Government Policy in The Netherlands (WRR)**

The form factor, capabilities, and price of the "mobile phone" of 2020 are hard to predict, of course. But I am sure that we won't think of it as a "phone" any more than we think of today's GPS navigation devices as "satellite radio receivers." Mobile broadband is becoming widespread, and hopefully the US will catch up with the rest of the world in terms of the price/performance ratio. **-Scott Brenner, technologist, Web developer, consultant for clients ranging from Fortune 100 companies to small non-profits**

Computers get smaller and become phones. Phones gain power and become Internet access devices. Phone computers like the iPhone are cheaper and more portable than other computers. They are already used for group access to information and communication in India and Africa. I expect to see much, much more of that. **-Paul Jones, director of ibiblio.org at University of North Carolina-Chapel Hill; the original manager of SunSITE, one of the first Web sites in North America**

The move to a single primary form of wireless access to voice- and data-related services seems to me to be unstoppable. Whether we'll recognize it as what we think of today as a "mobile phone" is questionable. **-Christopher Jacobs, chief operating officer, Solutions for Progress Inc.; formerly with KnowledgeFlow Inc. and Unisys Corp.**

Already today it is becoming hard to distinguish between a mobile phone and a computer. It is likely that this distinction will be obsolete in 2020, hence the question will not seem relevant at that time. **-Olav Anders Övrebö, media blogger and former Netzeitung journalist, University of Bergen**

There is no doubt that the desktop PC and even traditional laptop will be surpassed by other, more lightweight devices—it is already happening. The only question is whether the access

device will still be thought of as a mobile *phone.* It could be an "ultra-portable" device which gets sold in channels more typical of the current lower-end laptop market. It will also likely serve as a cell phone, but that may no longer be its primary purpose. **–John Eckman**, practice director, Next Generation Internet, Optaros Inc., a professional services firm offering strategy, design, development and consulting services tied to open source software

Mobile phones are spreading faster in developing countries than anything but TV now, notably places that lack infrastructure for other kinds of broadband. So upgrading cell phones to higher capacity will make more sense outside the OECD. **–Joseph Straubhaar**, professor, University of Texas-Austin; research interests include international communication and cultural theory and information sciences and the digital divide

I do not think cell phones will provide "information in a portable, well-connected form at a relatively low price." At least not by 2020. As it stands right now, connecting to the Internet from my BlackBerry sucks! Cumbersome, hard to read, hard to TYPE—it offers me very little value although I pay an extra \$20 a month for Internet access, I'm not sure why. I guess for e-mail. And even that is a pain in the butt. That reminds me, I need to cancel that service. In any event, until they make cell phones from Mylar or something similar that can roll up or fold and put in my pocket or purse (yes, with touch features) and big keyboards and large screen, forget it! And that ain't happenin' by 2020. **–Virginia Bisek**, Web content developer and writer

It's also possible that small portable handheld computers, connected to a global, ubiquitous WiFi connection, will replace smartphones—i.e. the Nokia N810. **–Beth Galloway**, Information Goddess Consulting, a Web 2.0 consultancy

The mobile phone as we know it will change and "smart phones" will become the de rigueur. There will still be roaming charges for global or country roaming and the couple of mobile providers that remain will be very territorial about their networks. We'll see people eschewing buying a PC but investing in a mobile device that also connects to other devices within their life. E.g. instead of buying a movie on demand via a cable box/DVR or apple TV. You'll do this via smartphone and it's sent to the device you specify to watch. **–Chris Miller**, senior vice president, digital operations and new business for Element 79, an advertising agency

Technically speaking, people will use "phones," albeit larger than current models, but the device will evolve into something like a "comm." device. **–Lynn Blumenstein**, senior editor, Library Hotline, Reed Business Information

The term mobile phone is something of a misnomer. Advanced mobile phones should be viewed more as multipurpose highly portable computing units. **–Daniel Fisher**, lecturer

While I agree with regard to the mobile phone being a primary "connection tool," I think that it may contribute to a divide between people who are primarily just "connecting" as brief communicators and as consumers and those who are substantial content creators. **–Jeremy J. Shapiro**, a professor of critical social theory at Fielding Graduate University with a research emphasis on the social and cultural effects of information technology and systems

While I generally tend to agree with this I think that the nature of the mobile phone will be significantly different than it is today. For example, I suspect that the screen will be much larger and roll out from the body of the device. **–Steven Hausman**, president, HausmanTech Consulting

While the mobile phone will dominate, increasingly it will expand beyond voice communications into text, images, video and other types of data. **–David F. Salisbury**, associate director for science and research communications, Vanderbilt University; formerly science and technology reporter for The Christian Science Monitor

The key here is the idea of the mobile phone being the primary Internet device. For most of the world, it will not. The mobile phone will be a peripheral to the main home computer just like televisions and dedicated portable music devices. **–Rob Boostrom**, Ph.D. student, Southern Illinois University-Carbondale, creator of the Society for Word of Mouth, "a group for educators to share ideas about sharing ideas"

My only reservation is the possible health and environmental effects of wireless phone/Internet transmission. For example, if people starve because the bee population is decimated by radiation, that could have an impact. **–Bruce Henry**, Concordia University (Montreal)

I don't agree with the part that it has a set of universal standards and protocols accepted by most operators internationally, but I do agree that the telephone will become the primary Internet connection. **–Christopher Brown**, strategist and managing editor of new media for the U.S. television program "America's Most Wanted" on FOX

One by-product of this development will be a narrowing of the number of Web sites routinely visited by users and a significant increase in the market power of a small number of wireless

companies (Verizon, Vodafone, etc.) to funnel traffic to a limited number of core Web sites. **-Timothy J. McManus**, vice president of healthcare product management for Nuance Communications Inc., a software technology company known for speech-recognition work

It strikes me that although I do indeed mostly agree, this guarded response is not guarded because I doubt that in the current economic and technological climate it can become thus, but instead due to a concern that the economic (and thus technological) climate may change for the worse between now and 2020. **-Francis J.L. Osborn**, futurist and activist, philosophy department, University of Wales Lampeter (formerly St. David's University College)

The mobile phone may be the primary connection in terms of number of hits, but not in significance. The quality of information that can be communicated via a cell phone is too low in terms of the amount of text that can be effectively read/reviewed, the quality of images that can be perceived, and the quality of sound. Perhaps it is wishful thinking on my part, but I believe that the most significant connections will still require skilled writing, images, and sound. **-Fred Ledley**, founder and chairman of Mygenome, professor of natural and applied sciences at Bentley College, Waltham, MA

I foresee the use of a digital device in the future as being an integrated platform that allows access to an individual's digital repository of data and computing capability. The device will be part phone, part media player, part "dumb" terminal enabling access, and possibly requiring biometric verification of a person's ID. Likely the individual ownership of a particular device will hold less importance as access to the network will be gained by using any device on which a user's ID can be verified. All applications allowing access to a person's data, workspace and networks will be reliant on this verification not the ownership of a particular device. Portability of access devices like this will be important. The idea is one encompassed by the notion of "ubiquitous computing." Anyone's guess as to the timeline but in 13 years it will definitely be further along. **-Sam Punnett**, president, FAD Research Inc.; has worked in the field of interactive digital media since the 1980s, for the last nine years on strategy, marketing, and e-business development

Most people will probably be "connected" via a mobile device that includes communications capabilities and some basic functions we currently associate with computers. However, these will not be "mobile phones" per se and they will probably not resemble current personal computers except superficially. They will, however, be able to be connected to powerful future personal computers and they will also be able to be connected to powerful computer systems where people may have personal accounts. While a very large percentage of the world's population will have basic access, the "digital gap" will actually increase as basic access will no longer really be sufficient. The gap between those with basic access and those with standard services in the near future will be like the gap between those who have a phone in the home which can receive calls from anyone but which is limited to emergency out-calls and those who have integrated phone-fax-Internet connections today. **-Benjamin M. Ben-Baruch**, senior market intelligence consultant and applied sociologist for Aquent, working at General Motors Corporation

This is a glass half-full assessment, since there are a variety of terrible threats to human life on the planet that could prevent the beneficial spread of mobile connectivity: major pandemic, nuclear winter, famine, severe climate change, the return of the Inquisition in some form or other. But, it seems just as likely that we could continue to muddle through, skidding along from disaster to calamity like pinballs in vast and blinking networked mobile metaverse. **-Havi Hoffman**, senior editor, product development, Yahoo!; co-author of "The Tech Buzz Game" and blogger

By 2020, mobile phones would expand their functionality to include common business and personal organizational applications, from daily agenda to simple text messaging and news tickers. They will store personal information on a memory card, and function like an access key for entrances, transportation passes, maybe even credit cards. For security and privacy purposes, mobile phones will probably include a finger print scanner or similar biometric devices. **-Clement Chau**, research manager for the Developmental Technologies Research Group at Tufts University

Whilst I agree overall I do think the nature of the device itself will have shifted. I suspect that it will no longer be seen just as a mobile phone, more as a sort of mobile companion. Perhaps even there will be separate devices that can plug into each other, thus forming new objects on their fusion, such as speakers to become a mobile entertainment device, flexible screens to become video devices, projectors to become teaching aids, etc. **-Richard Osborne**, Web manager for the School of Education & Lifelong Learning, University of Exeter; research focus is e-learning

The phone and computer are likely to converge, such that the phone has projected screens and keyboards. **-Mary Ann Allison**, principal, The Allison Group, has worked with Microsoft, Glasgow's Urban Learning Space, and other businesses, governments and NGOs

Mobile phone penetration accounts for 60% of the world's population in 2008 and with

low-cost handset initiatives underway, penetration can extend beyond 80% in 2020. **–Michael Skarzynski**, managing director, Red Lion Technologies Inc.

Web content is too complex / detailed for adequate display on the small cell phone screen. This will severely limit the usefulness of mobile telephony as an Internet connectivity tool. **–Richard Fowler**, auditor specialist, Northrop Grumman

Easy and cheap Internet access via mobiles will be the standard in areas with young infrastructure. In the west, especially in the US, easy and cheap alternatives such as wifi combined with expensive closed balkanized mobile networks will limit actual Internet access via cell phone. **–Ted M. Coopman**, lecturer, San Jose State University

Mobile phones have far greater reach than laptops (we see this currently), are portable, and have that “anytime, anywhere” feature that computers don't have. I suspect that mobile calls will get cheaper and the obstacles we currently experience with international calling will disappear. I predict by 2020 most mobile phones will have Internet access & GPS capability. People will use them for communicating and for gathering information. **–Rachel Kachur**, behavioral researcher, U.S. Centers for Disease Control & Prevention

I do not see blanket interconnectivity as necessarily a positive scenario. **–Alex Don**, linguist and educator

If you look at the speed at which we have already connected close to a billion people online, combined with power of mobile phone technology, combined with hope, then the dream of bringing everyone into the conversation can be a reality. **–Tiffany Shlain**, founder of the Webby Awards, co-founder of the International Academy of Digital Arts and Sciences; named one of Newsweek's “Women Shaping the 21st Century”

In purely statistical terms the mobile will have to be the primary contact for the majority. However, in spite of improved interfaces, etc, it will (arguably) remain an unsatisfactory platform for accessing much Web information. Some form of PC—be it laptop or PDA—will retain an important role, simply because of the sheer size and accessibility of the available display area. **–Roderick White**, editor, Admap magazine, World Advertising Research Center

I agree in general. However, for many people in the developed world, there will be several devices connected to the Internet, including the GPS in the car, home TV, screens throughout the home (kitchen, bedroom etc.), home theatre and/or music center (formerly known as the stereo), etc. Without a giant leap in voice-recognition, laptops and desktops will abound and all will be connected to the Internet. As devices shrink, so too, do they grow. Look at how the viewing area of TV screens has grown as the size of MP3 players and phones has shrunk. Video will be on its way to becoming the dominant format on the Internet. **–Peter W. Van Ness**, president, Van Ness Group, a Web-development company; founded Personal Computer Solutions in 1983; co-founded StockPlan, Inc. and MyStockOptions.com

We'll be using smart devices that are phone-sized—yes—but the devices themselves will be more a portable laptop than what we now know as a phone, and satellite broadband access will be the way we connect—both to our telephone accounts, Internet, etc. So...not at all a telephone in the sense we think of it today. **–Sarah Houghton-Jan**, consultant for the Infopeople Project; digital futures manager, San Jose Public Library; author of the Librarian in Black technology blog

The term “Internet access” can be misleading and a poor determinant of digital inclusion. While I would agree that mobile telephony will be the tool of choice and that it is quite possible that access levels may reach 50%, I believe that actual “accessing” levels will most likely be much lower than that. **–Nathan Botts**, community informatics research associate at the Kay Center for E-Health Research; working on the national health information network (NHIN) and outreach

Today the mobile phone mostly still feels and acts like telephony. But soon, like cars measured in horsepower, the phone part of the mobile phone will give way to more and more wand-like applications. And in this measure, the phone will become a bodily extension. We'll touch our device and get access and feedback. So the mobile phone will become our world window, through which we reach out and are reached globally. **–Barry K. Chudakov**, principal, the Chudakov Company, a marketing and advertising strategies creative consultant who has worked with many major corporations, including Microsoft and Disney

Currently, there are many efforts under way to use mobile phones as a payment device. This will serve to increase people's reliance on mobile phones for Internet, payments, and communications. **–Denise Senecal**, research manager, Callahan and Associates, an Internet strategy consortium in the Washington, D.C., area; expert on Internet and mobile banking strategies

Your mobile phone is your PC, there are no longer two devices or concepts. **–Robert Grant**, chief executive officer, VoyaCare Inc., a medical connector company

If universal standards are adopted this scenario will be true. **-Dan Weingrod**, vice president for digital operations, Cronin and Co.; oversees creative online initiatives for integrated marketing communications company

While mobile phones, however capable, will indeed qualify a person as connected and be of significant use because of their Internet connectivity the real power of the Internet will still not be available to those with only a mobile phone to access it mostly due to the issue of input/output; still hard to enter data and a small screen hard to receive many types of data and then usefully do something with it. Those tasks will remain on a workstation that is at least a laptop or better capability. **-Shawn Kelly Apochromantic**, configurations manager, designer, technologist, futurist, General Atomics, and volunteer builder in Second Life

90% of Internet access will be mobile; Differences between mobiles phones, smartphones, PDA, small PC like the EEE from Asus will have disappeared and we will carry with us "MID" (Mobile Internet Devices). **-Louis Naugès**, president, Revevol, an enterprise 2.0 company with offices in France, Spain, the UK and US; a founder of Microcost, an IT services and hardware company based in France

From what I gather, most of the people in the world who access the Internet do so via mobile devices *already* here in 2008. I don't what would happen to reverse this fact, i.e. I don't think that \$150 laptops will entice people away from their highly functional portable devices. **-Hank Dearden**, director of business development, Digital Industry Inc., a provider of technology services in the Washington, DC, area

The mobile phone is changing the way we communicate and will continue to do so. It is the best device for most people around the world, as it is portable, less cost prohibitive than a laptop, and allows for both push and pull communication. **-L. Suzanne Suggs**, assistant professor of communication sciences, University of Lugano; research focuses on use of new media and messaging strategies to improve health status

I see the phone as it evolves into something more than a phone but a personal communications device more than a phone—the proverbial thin client to access all of what is currently on the Web. **-James Gorman**, principal, Working Technology Partners, a company offering technology solutions to businesses

If the concept of "mobile phone" means a battery-powered device that is always connected, then that will be a large enabler for the future. However, the current devices have focused their richness on direct communication (voice), entertainment (audio-video), and short-burst communication (e.g. text messages)—not on information access, interpretation, synthesis and use. They may prove unsuitable for many purposes. Also, we need to better understand the future role of situated computing (connected devices built into other things like vehicles, appliances, even buildings). **-Duane Degler**, user-centered designer and strategist for Design for Context, writer and editor for IPGems, focused on knowledge management, semantic integration and performance improvement

Open global standards must be the technology norm. However, individuals will continue to connect only with their own cohort -- open standards do not make open minds. **-Nancy W. Bauer**, chief executive officer and editor-in-chief, WomenMatter Inc.

Though the mobile phone will be the primary connection tool for most personal interactions, some sort of computer will remain the primary connection tool for most business interactions. **-Alan Webber**, senior analyst, Forrester Research, focused on business-to-business, eGovernment and public sector linkages

Certain specialized activities—professional correspondence, interactions with health care providers, scholarly research—will follow different paths, partly because of issues of confidentiality and privacy and partly because of the nature of the communication. In particular, interactions that imply length, analytical depth, and a generally more discursive mode, will simply need more functionality (screen real estate, keyboard or mouse, functions, computational power) and are unlikely to migrate to the handheld devices. **-Amy Friedlander**, director of programs for the Council on Library and Information Resources, a non-profit that services research and higher education

Telephony under universal standards and protocols is the weakest part of this scenario. **-J.W. Huston**, president of Huston Consultancy and futurist

In the developing and poorly developed world mobile phones will continue represent the most cost effective communications infrastructure. **-Jim Lucas**, Web manager, CACI, a provider of national security, defense, and intelligence-related solutions in the interests of the United States

Beyond the fact that phones would seem to be more common devices than lap tops or PCs in the developing world, I would assume that cell coverage would continue to be a better connectivity option than dial up or any other possible form of broad band. **-Douglas Schulz**,

managing editor for online publishing, America's Health Insurance Plans; formerly a Web team director for a biotech industry organization and manager of Internet and Web services at the Council of Better Business Bureaus

The mobile phone will be the primary connection tool before 2020, especially outside the US where the technologies are leapfrogging our own because they don't have the legacy infrastructure/mentality that we do. **-Kathryn K. Goldfarb**, *president, KG Communications, an independent consultancy*

I accept that the processing power of mobile phones may be powerful enough to make this scenario possible. I have some reservations about the ability to create an adequate user interface on a mobile phone. **-Mike Langum**, *Web developer, U.S. Office of Personnel Management*

I think online access through mobile phones will be ubiquitous by 2020 but I don't think it will be the primary connection tool. **-Jay Buys**, *vice president for digital development, Fleishman Hillard, an international marketing and communications company*

The mobile telephone is one of the more disruptive technologies to arrive in the past 25 years. While the "one-laptop-per-child" is a pleasant pipe dream, the relative immediacy of mobile telephony and the relative low initial-investment per user makes mobile Internet very much an obtainable goal in the developing world. Indeed, mobile telephony's relative independence from the traditional wired Internet infrastructure makes it even more appealing to developing countries. Two of the larger challenges going forward are the limits of current wireless bandwidth and competing wireless telephony (e.g., GSM versus CDMA). These issues, however, are eminently surmountable. **-William Winton**, *product manager, digital media, 1105 Government Information Group*

Just as marketers/corporate interests have driven much sustainable development across the world up until this point, they will have a similar effect in the transformation of mobile technologies. The ability to dig deeply into individual users and understand their consumer habits, detailed demographic information and geographic movements is fast becoming the holy grail of marketing. Marketers will continue to drive for standardized protocols across the mobile spectrum and simultaneously absorb many of the costs involved, thereby driving barriers to access down for lower income populations. **-Kent Kirschner**, *media specialist, Neighborhood America, inviting companies to understand the power of community building online*

Unless there are substantial technology improvements to mobile sets, it will continue to be a mix of wired/wireless Internet connections. More home-based Internet appliances will be purchased. --Mack B. Rhoades Jr., *Web services product manager, Michael Baker Corp.* We're making children faster than laptops. **-Edward Lundquist**, *senior science advisor, Alion Science and Technology; formerly of the Center for Security Strategies and Operations of Anteon Corp*

This changes the line between author and reader on the Internet. Telecom access is thumbing, or perhaps voice to text, both of which encourage first draft product. New uses, new opportunities for aggregating information (news), less reasoned thought development leads to what? **-Dick Davies**, *partner, Project Management and Control Inc.; past president of the Association of Information Technology Professionals*

More than adequate computational power and memory will fit into the cell phone form factor by 2020. The primary limitation will be display area. We may well see cyber-cafes providing large screens, rather than WiFi connections. The power of OLPC will also have grown enormously, to the point where they will replace most current desktop and personal computers. **-James Jay Horning**, *chief scientist, information systems security, SPARTA, Inc.; a former fellow at Xerox's Palo Alto Research Center; Fellow of the ACM*

While the mobile phone might represent the primary connection tool for most people in the world, a drawback of the user interface will still mark a divide. Those with the kind of rudimentary connection now available via mobile phones will be able to access information but will not be able to construct informational "hubs" as effortlessly as those with more robust tools. **-Kirk Munsell**, *Webmaster and science writer for the Jet Propulsion Laboratory*

The underlying question is whether the U.S. will join in the mobile phone revolution. Why hasn't the market force economy of the U.S. followed the other world economies in a more multi-faceted integration of the mobile phone into daily use. And if it doesn't, will the U.S. lose the increased productivity stimulated by connectivity. **-Michael Castengera**, *senior lecturer at the University of Georgia's Grady College and president of Media Strategies and Tactics Inc., a media consulting firm*

The emerging cheap computers offered to disenfranchised children will encourage a whole generation to look for digital economic solutions to their poverty. Inefficient institutions be replaced with (excessive?) technological enthusiasm & determinism, leading to a significant

connection rate.—**Bertil Hatt**, researcher of Internet and social services, innovation valuation; employed by France Telecom and Orange (information technology and services industry) while completing Ph.D.

The cell phone will become the single entry point to the Net. The TV will likely remain the home-based access point, but the soon to be delivered OLCN and electronic paper could alter that aspect as well. —**Richard Hammond**, knowledge management team leader, United States Environmental Protection Agency; knowledge management expert currently examining Semantic Web and RFID

Considering the difficulty involved in installing and upgrading physical delivery systems, it only makes sense that telephony and wireless connectivity be the desired norm in 2020. —**Patti Nelson**, a Webmaster who works on U.S. government sites

The human interface to an Internet capable device must have a very significant technology breakthrough. Laptop and desktop computers of today are barely adequate and new phones like the iPhone are just toys. Voice recognition and eye tracking on a screen will need to become reliable interface methods. Direct interface through brainwave activity will hopefully become at least experimental. —**Dixon Hutchinson**, software engineer

It's convenient and cheap and easier to carry around than a laptop and if it gets lost, damaged or stolen, is easier and cheaper to replace. In developing nations, the mobile phone is leapfrogging laptops and fixed line net access—skipping a generation. —**Helen Keegan**, founder of Beep Marketing, a self-employed consultant and a judge for the Webby Awards

There are two factors that will probably see Internet access via the mobile phone achieve higher penetration. In developed countries, Internet access via mobile phones will probably achieve higher total penetration on account of being an individual, rather than household technology item. Many people are likely to have a mobile Internet access device they will use as a complement to their home/work-based access solutions. The ability to be "online —anywhere, anytime" via such devices is likely to see them achieve widespread adoption. In less affluent nations, the price of Internet enable handsets and actual data charges will obviously have a big impact on their takeup. But something that might also tip the scale in favor of mobile via handsets is power requirements. Browsing the Internet on a small screen (handset) is probably going to require less power than on the big screen, and this may make a difference in some parts of the world. —**Heath Gibson**, manager of research and market analysis, Big Pond, a competitive intelligence company and provider of broadband customer Websites in Australia